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REVIEW

Internal coherence matters: Lessons for nutrition and dietetics research

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Abstract

Aim: Internal coherence in research refers to the alignment between ontology (nature of reality), epistemology (nature of knowledge), axiology (values), methodology and methods and is an important but often overlooked element of research quality. We therefore aimed to illustrate the concept of internal coherence in nutrition and dietetics research, and its importance beyond individual elements of study quality.

Method: A targeted literature search in *Nutrition and Dietetics* was used to identify research illustrating one example of three main approaches to research (scientific, interpretive and critical inquiry) published between November 2017 and November 2020. Studies were included if they related to education research based on the expertise of the authors, and illustrated diverse points about internal coherence. The authors independently critiqued included studies for internal coherence and synthesised their findings.

Results: From 76 manuscripts, 14 were identified as describing education research. Of the three selected studies that were critiqued, all had elements of internal coherence, in particular alignment between epistemology and methodology. However, each had elements of misalignment too, specifically between epistemology, axiology and method. The results point to the profession's historical groundings privileging the scientific approach, showing how this can yield misalignments, particularly when describing the limitations of interpretive and critical inquiry approaches.

Conclusion: This review demonstrates the importance of internal coherence as a marker of quality, over and above existing quality assessment checklists for qualitative and quantitative methodologies. As such, it can help authors, reviewers and editors to improve the quality of nutrition and dietetics research and its reporting.

KEYWORDS

epistemology, editorial policies, qualitative research, methods, peer review, social research

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1 | INTRODUCTION

Nutrition research has evolved from a foundation in biomedical sciences towards its more recent recognition as a social science.¹ Key movements including, but not limited to, the New Nutrition Science have criticised *nutritionism*, and argued for recognition of social and environmental determinants of food and eating behaviour and choice.^{2,3} Alongside this transition, nutrition and dietetics research now preferences whole of diet approaches acknowledging complexity, rather than focusing on single nutrients.⁴ However, nutrition and dietetics research remains somewhat “reductionist”.² It typically focuses on hypothesis-driven questions determining causal pathways based on a philosophy that views knowledge as part of a reality distinct from individuals and demonstrable through scientific methods that largely employ quantitative approaches.^{1,3,5} This *scientific* (or *positivist/post-positivist*) approach has dominated nutrition and dietetics research for the past century, despite widespread acknowledgement that nutrition is environmentally, socially, culturally and historically bound and thus involves both art and science, yet there remains little appreciation of what the “social” involves.²

Given that many research questions in nutrition deal with the complexities surrounding diets, dietary behaviours and knowledge translation into practice, and the interaction between people and society,¹ different approaches are needed. Consequently, there have been calls to move nutrition research away from positivist approaches towards those encompassing the social, cultural, economic, geographical and political influences on nutrition.^{2,6} There has been recent criticism that nutrition research continues to focus on linear biological causes and classifications in nutrition and the need to focus on wider influences on nutrition to create effective practice and policy solutions remains.³ A range of research approaches are embraced in nutrition and dietetics research to address this complexity.

While methods are usually reported well, often researchers typically overlook making explicit their underpinning philosophies and/or misalignment exists between their philosophical stance and their methodology and methods.⁷ Quantitative research has not been subjected to the same level of scrutiny as qualitative research.⁸ Regardless of approach it is important that internal coherence is considered within both qualitative and quantitative research. Internal coherence refers to

the alignment between the philosophy, methodology and methods of research.^{9,10} Misalignment of these features of research can result in researchers not fully addressing their study aims or research questions. Although qualitative and quantitative approaches traditionally sit within certain philosophical standpoints, this is not always the case. With increased expectations for mixed methods research approaches in nutrition and dietetics, alongside the recognition that theory cannot be neatly separated from practice, all researchers must consider internal coherence matters within their research.

To embark on social science research, researchers must understand the theoretical assumptions of their research. Social science requires sound methodologies and methods, together with clear justification of chosen approaches.⁹ This requires acknowledgement that all research is grounded within a certain stance providing context and directly influencing the research. This means acknowledging that in all research—across quantitative, qualitative, and mixed methodologies—reality and knowledge are conceptualised differently. A research approach consists of five components: ontology, epistemology, methodology, axiology and methods (see glossary Box 1).⁹

Ontology, or the nature of reality, is the building block of research and requires reflection on the assumptions of what is real. For example, in the scientific approach typically used in nutrition research, researchers are often seeking a single reality.⁹ Epistemology, or the nature of knowledge, answers the question “how do we know what is true?” For example, in the scientific approach typically used in nutrition research, the epistemology is objectivity, that is, knowledge is believed to exist outside of human consciousness. Epistemology requires researchers to reflect on how they engage in research, the values, as well as the methodology (process of constructing data that generates the knowledge) and methods (the tools) they use to develop knowledge.^{8,9,11} We argue in this manuscript that these principles, while ever present in all research, are rarely made explicit in nutrition research despite informing methodology and methods. The internal coherence or alignment between these elements are the focus of the remainder of this discussion paper. Internal coherence is important as it makes clear the conventions of the research to support interpretations and enhance quality.

BOX 1. Glossary: Abbreviated glossary of terms underpinning internal coherence and research quality. See also Table 1 for examples of these terms

Axiology—values that underpin the research.⁵¹

Confirmability—confidence that data represents participants' perspectives rather than those of the researcher.⁵²

Credibility—believability of findings.⁵²

Dependability—applicability of findings at other times.⁵²

Epistemology—nature of knowledge and knowing.⁹

Generalisability—extent to which the findings of a study can be applicable to other settings.⁵²

Method—approaches to collecting evidence.⁹

Methodology—how we develop the knowledge or theories about how research should proceed.¹⁰

Ontology—what is real and the nature of reality. Relates to people's understanding of the nature of the world.⁹

Reflexivity—understanding one's own position in order to gain insight into the perspectives of others. Articulates researchers' assumption, offers questions and calls attention to how knowledge is created.⁸

Reliability—consistency and accuracy of data.⁵³

Transferability—the applicability of the findings to other populations or groups.⁵⁴

Validity—data received are indicators of the construct being measured.⁵³

Three prominent approaches or philosophies to research are scientific, interpretivist and critical inquiry. Descriptions of the ontology, epistemology, methodology and axiology of these three approaches are defined in Table 1. In summary, scientific (also called positivist) approaches view knowledge as objective, that is, there is one truth to be discovered. Post-positivism is closely aligned with positivism but acknowledges that while objective truth exists, it is unlikely to be fully comprehended as measurements are flawed.¹² Positivist and post-positivist approaches are valuable in specific situations, for example, researchers wishing to explain the effectiveness of an intervention or tool. While those

applying scientific approaches are rarely explicit in their philosophical assumptions or standpoint from which their research questions are derived, they do begin their studies with a theory, typically developed from observations or understandings drawn from existing research producing a formal hypothesis to be tested.^{12,13} Interpretivist approaches, on the other hand, see knowledge as subjective, something that is developed through social interaction.¹⁴ Its value is in acknowledging the role of the individual's experience and interpretation in creating understanding (or knowledge). Critical approaches view knowledge as cultural, with researchers seeking to challenge the status quo and facilitate change in this approach.¹⁵ Critical approaches aim to uncover underlying structures (including geographical, historical, social, cultural, environmental and physical) influencing the concept being researched.¹³ The value of critical approaches has been recognised in the critical dietetics movement, which is dedicated to focusing our attention on issues of privilege, power and marginalisation in dietetics.^{1,16} Choice of approach can be based on the purpose of the research, researchers' positioning within research processes, and research questions.

Research quality is important, influencing both future research and the knowledge applied to practice. Qualitative and quantitative research have different purposes, so consequently have different markers of quality. Consistent with evidence-based practice, there has been greater focus on standardised approaches to evaluating research papers for quality. Criteria for assessing rigour are available for both qualitative and quantitative research.^{17–20} Quantitative assessments involve appraisal of validity, reliability, bias and generalisability.²⁰ Quality assessment in qualitative research focus on rigour markers including dependability (verifiable), credibility (reliable author interpretations), confirmability (researcher personal position transparent) and transferability (sample transferable to other contexts).²¹ Qualitative researchers have suggested ways of describing rigour that go beyond checklists that arguably privilege scientific approaches.⁷ Regardless, such quality markers alone are insufficient, if philosophical position is ignored.

In summary, internal coherence matters. The connection between epistemology, methodology, axiology and method, which ensure internal coherence is as important as checklist markers of quality in research. Researchers must consider their relationship with study participants when considering their philosophical standpoint. Epistemology influences both choice of methodology, axiology, and how methods are implemented and analysed.²² The methodology is the key tenet that informs study design, aims and research questions, and the steps taken in the research process, as well as connecting the research with

TABLE 1 Prominent research approaches in dietetics research

Element of approach*	Scientific	Interpretivism	Critical inquiry
Overview	Objective truth, proof and causation	Human social interaction in life	Political, ideological factors and power within society; promoting change
Purpose is to...	Explain or Predict, eg, <i>What is the relationship between...?</i> <i>What factors relate to...?</i> <i>What is the effect of...?</i>	Understand, eg, <i>What are the views of...?</i> <i>What are the experiences of...?</i> <i>How do stakeholders understand...?</i>	Emancipate, facilitate change, eg, <i>What structures (political, cultural, power) underpin oppression of a group?</i> <i>How might this group be empowered?</i>
Theoretical perspective	"... embraces certainty, seeks universal laws that govern behaviour, and argues an objective external reality that can be accurately and thoroughly understood" ^{12,p695}	"... looks for culturally derived and historically situated interpretations of the social life-world" ^{9 p67}	"... to question the assumptions of dominant forms of thinking by challenging the power relations..." ^{13,p843}
Ontology What is real and the nature of reality	Typically Realism Reality is singular, tangible, identifiable and measurable	Typically Relativism Reality is multiple and based on context, past experiences, etc.	Typically Historical Realism Reality is multiple, shaped by structures, and language can only help partially understand reality
Epistemology Nature of knowledge and knowing	Objectivity; Separation between researchers and research participants (research conducted from the outside)	Subjectivity, Co-construction of knowledge between researcher and participants (research conducted from the inside)	Collectivity, Privileges participant voice (research conducted alongside participants as co-researchers)
Methodology How do we develop knowledge	Examples: Randomised/non-randomised controlled trials, Cohort studies, Case control studies	Examples: Ethnography, Phenomenology, Constructivist Grounded Theory	Examples: Participatory Action Research, Video-Reflexive Ethnography
Axiology/Values Values that underpin the research	Objectivity, Dualism	Language, Social interaction, Context	Democracy, Egalitarianism, Emancipation, Change
Method Approaches to collecting evidence	Typically quantitative (eg, dietary intake, anthropometry)	Typically qualitative/ naturalistic (eg, interviews, observation and documents)	Typically naturalistic/ qualitative and participatory (eg, participatory focus groups, photo-voice)
Rigour	Validity, Reliability, Statistical power, Generalisability	Dependability, Credibility, Confirmability, Transferability, Reflexivity	Emancipatory potential, Dependability, Credibility, Confirmability, Transferability, Reflexivity
Sample	Sample size powered to detect effects	Sample size for information power ⁴⁹	Sample size powered to facilitate change

*Note: The summary presented in this table is largely based on our synthesis of key references.^{9,12,14,50}

theory and the broader discipline.¹⁰ Thus, when embarking on nutrition research, a researcher must first choose their epistemological position, then select their methodology (or elements of existing methodologies), consider axiology, then select methods consistent with the chosen epistemology, methodology and axiology to produce the best data to answer the research questions.¹⁰ Finally, the researcher must apply their approach, mindful of markers of rigour consistent with their chosen approach, rather than different approaches with alternative ways of understanding reality, knowledge and how knowledge should be created. This research therefore aims to illustrate the concept of internal coherence and its importance beyond individual elements of study quality through critique of selected research from this journal. This paper also hopes to support peer reviewers and editors to provide constructive feedback regarding research quality and internal coherence.

2 | METHODS

A targeted literature search based on PRISMA guidelines was used to identify published research illustrating the three chosen prominent research approaches, as well as diverse points about internal coherence. The authors, with collective experience in health professions education research using primarily interpretive approaches, focused on identifying studies that, given their backgrounds, they could effectively critique. Therefore, only manuscripts describing the scholarship of teaching or learning, or credentialing/registration, or education were included such that an informed critique of internal coherence could be made. A simple electronic search was performed within PubMed to identify relevant articles. Studies were considered for inclusion if they met all of the following criteria: any original study focused on dietetics education or credentialing, published in the journal *Nutrition and Dietetics*, with a publication date between November 2017 and November 2020, and where the manuscript provided opportunities for illustrating diverse points about internal coherence. The inclusion of studies only published in *Nutrition and Dietetics* aimed to offer critique and a quality improvement process for the journal given that two of the authors are on the Editorial Board of the journal.

The following search terms were used: “Nutr Diet”[jour] AND dietetics AND (credential OR examination OR workforce OR education). Results were screened by title and abstract, with those included at this stage being assessed against the eligibility criteria through full text review. Articles were excluded if they were an editorial or commentary, review, reported a single case study, or were not a full research paper. Short reports, including

letters to the editor, were only included if the paper was at least two pages in length, detailed the methods used, and reported study findings.

Three studies (one from each of scientific, interpretive and critical approaches) were selected based on the inclusion criteria and especially the manuscripts' abilities to illustrate the stated philosophy and be critiqued for internal coherence. Data were extracted in duplicate from each of these three manuscripts including title, research approach, aim, methodology, methods and key findings. All authors reviewed the manuscripts making notes critiquing issues of quality including internal coherence. These notes were synthesised and summarised into the following analysis by all authors.

3 | RESULTS

The search yielded 76 manuscripts published between November 2017 and November 2020, with 58 excluded through title and abstract screening. The remaining 18 potential articles underwent full text review and were assessed against the eligibility criteria, resulting in 14 included articles describing dietetics education or credentialing research. Of these studies, three focused on competency standards,²³⁻²⁵ four on assessment,²⁶⁻²⁹ five on curriculum,³⁰⁻³⁴ and two on continuing education^{35,36} (Table 2 and Figure S1). These characteristics were reviewed by the authors with the aim of identifying one published example from scientific,²⁸ interpretive³¹ and critical²⁴ approaches that could best illustrate the stated philosophy and be critiqued for internal coherence. The selected papers are summarised in Table 2 and discussed critically below; initially presenting a summary of their study aims and approaches and then critiquing their internal coherence in line with their approaches. We first highlight their strengths before identifying issues with their internal coherence.

Scientific approach: Parkin and Collinson²⁸ took a *scientific* approach to examine the relationship between objective structured clinical examination (OSCE) performance and placement performance. They also sought to understand students' perceptions of the benefits of their OSCE. The first aim is clearly scientific in its philosophical orientation; reflective of how this is phrased in their abstract (Does the OSCE *predict* placement outcome?). Their second stated aim (student *perceptions* of the benefits of the OSCE in preparation for practice) however is arguably not scientific (implying multiple perceptions of reality). As is typical of scientific approaches, the authors use the existing literature to develop a hypothesis for their research. The values (axiology) of the research are implied through the use of purportedly objective measures.

TABLE 2 Key characteristics of three studies selected for critical analysis

Reference (Methodology)	Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)	Focus; Aim(s)	Data collection	Data analysis	Results reported	Conclusion
Parkin and Collinson ²⁸	Approach not stated; Survey; Some IC	Assessment; To explore whether an OSCE predicts dietetic placement outcomes and student perceptions of the benefits of the OSCE in preparation for practice	Questionnaires, OSCE outcomes, Placement outcomes	Frequency (percentages), ANOVA	The overall OSCE score was associated with student placement outcomes. Those who struggled during, or failed the placement, achieved similar OSCE scores. 36% (9/25) of students who failed an active station on the OSCE did not pass placement. Students found the OSCE stressful but there was evidence of reduced stress over years.	The OSCE is a meaningful assessment of practical skills, which provides some prediction of placement performance, particularly for active stations.
Morgan et al, 2019 ³¹	Social constructionist epistemological position; Qualitative description; Some IC	Curriculum; To explore the experiences of, and challenges faced by, academic dietetics educators in preparing dietitians for the workforce	Interviews	Thematic analysis	One overarching theme (Aiming for a moving target) and three sub- themes: 1. Striving for betterment 2. Bridging dissonance 3. Distressing impossibilities	Dietetic educators face challenges in preparing a workforce equipped for diverse dietetic practice areas.
Palermo et al, 2019	Critical approach; Action Research; Some IC	Fellow credential; To describe the characteristics of a Fellow and critically review factors relevant to recognition and promotion of excellence within the Australian dietetics profession	Focus groups	Thematic analysis, drawing on CHAT	Four themes: 1. Fellow is associated with leadership 2. Credential is out of reach 3. Never be good enough 4. Lack of recognition deters application	Changes to the system are required to promote uptake of the credential by the profession.

TABLE 2 (Continued)

Reference (Methodology)	Focus; Aim(s)	Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)	Data collection	Data analysis	Results reported	Conclusion
MANUSCRIPTS NOT SELECTED FOR DEEPER ANALYSIS ($n = 11$ listed alphabetically)						
Ash et al, 2019 ²³	Competence; To explore how a competency-based education framework influenced competency standards and how competency-based education has influenced dietetic practice in Australia since 1990	Approach not stated; Qualitative investigation; IC	Reanalysis of previously collected data over time; (1) Interviews with new graduates and guided discussion groups with graduates and employers; (2) competency standards and accreditation manuals/standards	Thematic analysis (interviews and groups), content analysis (documents)	Four themes evolving longitudinally: 1. Communicating for better care 2. Scientific enquiry for effective practice 3. Critical thinking and evidence-based practice 4. Professionalism	Competency-based education has promoted an outcomes focus from 1993 and continues to influence curriculum, assessment and accreditation policy.
Bacon et al, 2018 ²⁶	Assessment; To evaluate a Consensus Model for competency-based assessment	Constructivist-interpretivist; Delphi and Qualitative description; IC	Three-round modified Delphi process, focus groups, interviews	Level of agreement, proportions for Delphi, thematic analysis for groups/interviews	Final assessment of assessor panel disagreed with at least one placement educator for 34% of students, while students and capstone outcomes agreed with assessor panel Consensus model supports sustainable assessment practices	Findings support an interpretivist approach to assessment that uses evaluation as a catalyst for learning, is holistic and uses a panel of assessors for high-stakes decisions.
Butler et al, 2018	Curriculum; To identify how students in Australian tertiary dietetics programs are being prepared to provide services to those with disabilities	Approach not stated; Mixed methods descriptive approach; Some IC	Survey comprising 8 open-ended questions	Inductive “category themes” were quantified; descriptive statistics applied to most frequently occurring themes	12 out of 14 programs included at least one curriculum opportunity that included disability 8 out of 14 programs reported a disability specific lecture 9 out of 12 participants described their views on the relevance of disability to dietitians.	Dietetic programs vary in their disability content. Research needed to better define disability-related competencies.

(Continues)

TABLE 2 (Continued)

Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)					
Reference (Methodology)	Focus; Aim(s)	Data collection	Data analysis	Results reported	Conclusion
Chiavaroli et al, 2018 ²⁷	Competency assessment; To assess the knowledge, skills, capabilities, and professional judgement of overseas-educated dietitians against CS	8 administrations of an MCQ exam over 5 years	Validity of the MCQ exam, relationships with other variables, stability of cut score, pass rates	52% candidates passed on the first attempt (most candidates from English-speaking countries passed on first attempt) Overall difficulty of the exam was relatively stable in terms of cut scores but pass rates varied by cohort Test reliability was mostly above 0.70.	The MCQ exam demonstrated acceptable reliability and validity
Palermo et al, 2018 ²⁵	Competence; To explore how dietetics students ready to graduate construct the concept of competence and the role of assessment in developing professional competence	Approach not stated; Qualitative description; IC	Focus groups	Inductive thematic analysis	Four themes: 1. No shared understanding of competence 2. Current placement experiences may not reflect current standards or workforce needs 3. Assessment approaches may not fully support competence development 4. The competence of workplace supervisors influences student constructions of competence Need to develop alternative work placement experiences reflecting workforce needs. Practitioners should recognise their influence in shaping students' construction of competence.
Porter et al, 2019	Assessment; To review and moderate an assessment artefact of foodservice WIL to	Approach not stated; Portfolio artefact analysis; Some IC	Blinded moderation of WIL report by multiple assessors; focus group	Description of assessment outcomes, thematic analysis	Variation of assessment outcomes was evident. Three themes: Inconsistency of outcome across multiple assessors highlights the need to rely on multiple assessments

TABLE 2 (Continued)

Reference (Methodology)	Focus; Aim(s)	Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)	Data collection	Data analysis	Results reported	Conclusion
	demonstrate competence				<ol style="list-style-type: none"> Importance of understanding the project scope Influences on assessment decision-making Importance of understanding broader assessment program 	and for shared understandings of competency expectations at practice entry.
Svarc et al, 2018 ³²	Practice (Placement) Education; To explore the impact of Aboriginal health placements on graduates' attitudes, confidence and preparedness to work in Aboriginal health	Approach not stated; Sequential mixed methods; Some IC	Survey, Semi-structured interviews	Descriptive and inferential statistics, content analysis	<p>Participants with Aboriginal placement experiences were more positive towards Aboriginal people/health, more confident and more likely to work Aboriginal focussed role</p> <ol style="list-style-type: none"> Situated learning experiences Breaking down stereotypes Empathy through learning from Aboriginal people Aboriginal health role models 	Aboriginal health placement experiences provide dietetic graduates with more positive attitudes and self-confidence working in Aboriginal health.
Twohig et al, 2019 ³⁵	Professional development education; To compare the characteristics of	Approach not stated; Case control study design; IC	Survey	Inferential statistics	Genomics trained group had higher mean knowledge, and	A relationship between training, knowledge, confidence and

(Continues)

TABLE 2 (Continued)

Reference (Methodology)	Focus; Aim(s)	Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)	Data collection	Data analysis	Results reported	Conclusion
	nutrition professionals who completed an online genomics course to those who completed an unrelated online course				confidence to perform 8 related activities than the untrained group. Both groups reported low implementation of nutritional genomics related activities in practice	involvement in nutritional genomics exists. Research needed to determine most effective methods for nutritional genomics education
Weber et al, 2019	Practice (placement) education; To evaluate the impact of a Clinical Educator model on the learning for students, preceptors and managers	Constructivist; Qualitative description; Some IC	Focus groups	Inductive thematic analysis	Four themes: 1. Clinical Educator improved time efficiency of placements 2. Clinical Educator facilitated student assessment within an assessment program 3. Clinical Educator was uniquely positioned to enhance student confidence 4. Clinical Educator improved capacity to manage underperforming and challenging student	Clinical Educator model increased student confidence, enhanced preceptors' capacity to manage underperforming students, facilitated assessment and reduced supervision burden.
Wilson et al, 2017	Professional development education; To explore the experience of dietitians participating	Approach not stated; Qualitative description; IC	Telephone interviews following 6 group mentoring sessions	Thematic analysis	Four themes: 1. Aboriginal health practice requires different ways of	The CoP is a useful approach for supporting dietitians

TABLE 2 (Continued)

Reference (Methodology)	Focus; Aim(s)	Philosophical Approach; Methods; Internal coherence (IC) (Yes/No/Some)	Data collection	Data analysis	Results reported	Conclusion
	in a CoP for work with Aboriginal communities				knowing, being and working. 2. The CoP is a safe place to discuss, debrief and explore ideas. 3. Participation in the CoP contributed to workforce retention in Aboriginal health 4. Participation in the CoP contributed to dietitians improving their practice in Aboriginal health	working in Aboriginal health.
Yang et al, 2018	Curriculum; To investigate the empathy of dietetic interns	Approach not stated; Cross sectional survey; IC	Two validated surveys	Inferential statistics	No correlation between self-reported and patient perceptions of empathy.	TEQ and CARE tools could be used for feedback to students on their empathy with patients and for curriculum development.

Abbreviations: CHAT, Cultural Historical Activity Theory; CARE, Consultation and Relational Empathy; CoP, Community of Practice; CS, Competency Standards; OSCE, objective structured clinical examination; TEQm, Toronto Empathy Questionnaire; WIL, work-integrated learning.

The authors do not make a clear case for their scientific approach and how it builds on existing understanding. Having two philosophical approaches (between their first and second aims) from the outset produces coherence issues as the researchers do not adequately consider, and explicitly report the considerations, from each approach at each step of their research. The authors' philosophy is not explicitly stated, which is a conventional feature of scientific approaches. However, given that the second aim was to understand student perspectives, philosophical transparency was required to achieve internal coherence. Indeed, this second aim aligns with qualitative methodology; however quantitative methods (in the form of a Likert scale) were chosen to understand these perspectives. Qualitative methods would have been more aligned (internally coherent) with understanding student perspectives. Supporting the researchers' presumed alignment with a scientific approach, their hypothesis is that placement performance is predicted by OSCE performance. Therefore, the research fails to consider alternative explanations for factors predicting placement performance, including other assessment tasks. Further, there is no acknowledgement of the complexity of the placement environment context that will almost certainly influence outcomes.³⁷

Taking an overt positivist or post-positivist philosophical approach that matches the scientific nature of this paper, the internal coherence of the study can be critiqued. The study's methodology, study design (retrospective cohort) and methods (observations measured as "grades" and Likert scale) analysed with one-way ANOVA are aligned with the scientific approach. These have been chosen by the researchers to objectively measure the relationship between OSCE and placement outcomes. However, there are assumptions made within this analysis which are neither explicit nor aligned with a purist scientific approach. Despite significant changes to the OSCE over the period of longitudinal data collection, the dependent variable (outcome) is largely treated as if it were unchanged across the years. Educational interventions are difficult to evaluate within a scientific paradigm for this reason, as well as the complexity of the settings in which they are administered.^{37,38} No reliability or validity measures of OCSE and placement outcomes were performed, representing further misalignment, resulting in unsubstantiated assumptions that these objective measures are "true" when in fact they are (we would argue) largely subjective. The researchers do not make explicit their values (axiology) but strongly imply a quest to find one single truth.

Considering the second stated aim of the research (student perceptions), the misalignment present is in the use of predefined statements with Likert scale responses

rather than qualitative methods, which would be better aligned with the aim. Likert scales are typically aligned with a scientific approach. The reported results confirm that the researchers have not fully explored students' perceptions, providing only the proportion of students agreeing with the researchers' predefined statements testing their hypothesis that the OSCE will predict placement performance.

Interpretive approach: Morgan et al³¹ took an *interpretive* approach exploring the experiences of, and challenges faced by, academic dietetics educators in preparing dietitians for the workforce. The study aim focuses on exploring experiences, challenges and perspectives based on past experiences (therefore privileging participants' subjectivities), making it clear that multiple realities are valued. The authors state that their study is underpinned by a social constructionist epistemology, and define this position. The methodology, labelled as "qualitative description", and methods, in-depth interviews, are closely aligned with the interpretive approach (so internally coherent). Data analysis, whereby meaning is constructed between participants' responses and researchers' interpretations, is made clear through the coding process. The results highlight the multiple stories and privilege context (in the study, university education and the cultural history of this) in data analysis. The discussion of results clearly highlight the complexity of the findings.

However, the introduction could more clearly highlight the need for an interpretive approach. While the authors reflexively describe their background and experiences, illustrating how those potentially influence their data interpretations, their motivations for doing so is to minimise bias (implying that dualism is key).³⁹ However, the minimisation of bias through dualism is privileged only in the scientific approach, rather than an interpretivist approach, which instead values the researcher-participant relationship in the co-construction of knowledge.¹⁴ How specifically the position of the researchers was managed or influenced data collection and analysis, and the development of knowledge (eg, how reflexive memos specifically managed this), could have been more clearly stated.

While the primary sampling approach involved maximum-variation sampling, aligned with gaining multiple perspectives, specifying a "random" approach within this sampling frame is misaligned with interpretive approaches. Indeed, aligned with the scientific approach seeking one universal truth, random sampling attempts to minimise bias and support generalisability.³⁹ Qualitative sampling however has a different purpose to quantitative sampling; instead trying to shed light on the particularities of phenomena.³⁹ Furthermore, using field notes for "validation" is again aligned with a scientific

approach (trying to find the “correct” interpretation), and inconsistent with quality markers in qualitative research.⁴⁰ The multiple perspectives are generally described as such, for example, using verbs such as “described”, “expressed” and “reflected”; however, occasionally through the results the authors present data as facts, for example, “some participants had unpleasant and uninspiring encounters” (p.385), which is inconsistent with the construction of understandings (as in “some participants reported...”). In their study limitations, the authors critique their study introducing terms like “validity” and “reliability”, which are terms aligned with the scientific approach. Their qualitative study is thus critiqued using scientific rather than interpretive quality markers. For example, they express avoiding desirability bias and leading during interviewing rather than embracing the subjectivity and co-construction of knowledge inherent in interpretive approaches (and inherent in their stated social constructionist approach). Indeed, it is highly problematic for researchers to critique studies with a stated philosophical position from an alternative standpoint. However, this appears to be somewhat common in published reports of qualitative research, either because researchers lack proper philosophical understandings of the different approaches, or because reviewers and editors lack such understandings, thereby mandating that researchers critique qualitative approaches from (preferred and known) scientific standpoints.

Critical approach: Taking a *critical inquiry* approach employing action research methodology and focus group methods, Palermo et al²⁴ critically reviewed factors relevant to recognition and promotion of excellence within the dietetics profession in order to facilitate change in Fellow credentialing. The researchers specifically stated their approach, enabling us to critique the paper for internal coherence. In the present study, positioning the problem of what constitutes excellence in the profession and how it is rewarded as an issue of power, structure and history clearly aligns the work with critical inquiry. Typically, critical approaches provide a voice to groups that are disempowered, presented in the present study as advanced practitioners. While this group may not be considered as marginalised or powerless typically; in the present study, the sample was presented as not having a voice. Specifically, the authors state that those not applying for Fellow had not previously had a voice in what constitutes excellence in the profession or how the Fellow credential was awarded. The authors' use of Cultural Historical Activity Theory⁴¹ is reasonably aligned with the critical approach in that it examines structural, cultural and historical factors influencing the social world, providing additional depth to their study findings.

The understanding of what constitutes excellence, a secondary aim of the study, is however more aligned with an interpretive approach, and identification of “factors” more aligned with a scientific approach, assuming these can be identified and measured. This misalignment also flows through to interview questions and the description of competency standards for Fellows, which departs from the mostly critical inquiry presented elsewhere. While the authors, being members of the profession and key stakeholders in the credentialing process, were aligned with a collectivist epistemology and espoused the need for change, there is limited description in the manuscript of the facilitation of change enabled through the research process. This highlights issues with axiology: the researchers clearly value making change but offer limited description in the paper about how change was enacted through the study. While critical approaches typically put participants at the centre of the research process, and indeed construct participants as co-researchers, the present study stated they achieved this through the researchers themselves being advanced practitioners-researchers. However, inconsistent with a typical critical inquiry approach, the focus group participants were not involved in the research design, or subsequent change processes hinted at. Engaging participants as co-researchers in the design and/or conduct of the research would have been more internally coherent with a critical approach.

4 | DISCUSSION

This manuscript has summarised scientific, interpretive and critical research approaches and described the importance of internal coherence between ontology, epistemology, axiology, methodology and methods for achieving research quality. Using an illustrative example for each of the scientific, interpretivist and critical approaches from dietetics education research, the importance of internal coherence has been demonstrated. Across the three manuscripts, all exhibited elements of internal coherence, in particular alignment between epistemology and methodology. However, each also demonstrated elements of misalignment, specifically between epistemology, axiology and method. Incoherence was typical where scientific principles were favoured despite the stated or implied philosophy. This highlights the profession's historical groundings privileging the scientific approach, showing how this can yield misalignment, particularly when describing the limitations of interpretive and critical inquiry approaches. The importance of internal coherence over and above existing quality assessment checklists for qualitative and quantitative methods must

be embraced into the future by researchers, peer reviewers and editors. The concept of internal coherence should be even considered as an additional quality marker, perhaps as an addition to existing quality checklists for all research designs.

The findings presented are consistent with calls in the medical education literature for the need to overtly articulate epistemological position to truly engage with the research outcomes.^{39,40,42} It is also consistent with other work demonstrating the dominance of the principles of scientific approaches being unthinkingly applied across other approaches,³⁹ and calls for internal coherence to be at the centre of quality judgements.²² It further supports narratives highlighting the limitations of checklists that do not support deep analysis of internal coherence in the review process. The present study also aligns with recent studies that outlines other key philosophical approaches to research. For example, in addition to interpretive, scientific and critical approaches, they also explore realism and socio-materiality.^{11,43-45} Within our search, there were no examples of these approaches, suggesting that papers published in *Nutrition and Dietetics* may be narrowly scoped in terms of philosophical approaches. Realist and socio-material approaches could be useful for nutrition and dietetics research. Realist approaches (such as realist syntheses and realist evaluation) have a scientific realism philosophy, which focuses on understandings of causality, often using mixed methods.⁴⁴ Socio-material approaches propose that the social and material worlds are connected and therefore explore the ways in which people and “things” interact.⁴⁵ Given the interaction between food and people, this epistemology has been proposed to assist understandings of complex problems of malnutrition.⁴⁶ What is not covered in this discussion is pragmatism, an approach also not returned in our search. Pragmatism focuses on experience and a continual process between beliefs and actions, embracing both singular and multiple realities/ontologies that aim to solve problems in real-world practice, often using mixed methods with a focus on the research questions rather than the methods.^{43,47} Skilled mixed methods researchers are able to effectively manage the conflict between opposing ontological and epistemological positions through careful attention to conceptualisation of both positions within the research problem.⁴⁸ While this is not an exhaustive list, it highlights the array of philosophies nutrition and dietetics researchers may consider, hopefully stimulating an appetite to read more.

The limitations of the present study include that the search limits possibly curbed the inclusion of relevant studies, as only manuscripts published in *Nutrition and Dietetics* and focused on dietetics education over the past few years were included. The inclusion of a critique of

the authors' own work (2 of 3 manuscripts) may be perceived as a biased selection by those viewing this paper from a scientific or positivist standpoint. One of these studies²⁴ was included as it was the only critical approach published in *Nutrition and Dietetics*; the other interpretivist example³¹ provided the best illustration of all potential interpretivist studies identified to demonstrate philosophical misalignment. This manuscript has summarised three prominent philosophical approaches to research and, through examples in dietetics education research highlighted the important role of internal coherence. What has not been presented is a synthesis of other philosophical approaches relevant to nutrition and dietetics research more broadly. The nutrition and dietetics research community may benefit from a more fulsome review of the extent to which internal coherence issues occur in practical nutrition and dietetics research.

The findings provide important implications for nutrition and dietetics research. Further consideration by researchers, peer reviewers and editors is needed on the importance of internal coherence. In addition, researchers working within any approach should ensure internal coherence between these elements in their research and should justify any areas of misalignment. Reviewers should avoid suggesting to authors that they revise their papers in a way that encourages misalignment, for example, criticising interpretive or critical inquiry research (often qualitative) for being self-reported, for bias, for lack of generalisability, or conversely, scientific approaches for lacking researcher reflexivity. Authors and reviewers must ensure an overt position is stated in research and that there is alignment between stated position and approach, rather than sole reliance on quality assessment checklists as a marker of quality.

In privileging scientific approaches to research, we cannot truly understand all complexities influencing nutrition in the social world. Classifying research as qualitative or quantitative does little to articulate the values or premises from which research is conducted and how knowledge is generated. The authors argue for consideration of epistemology at the outset of research, together with concerted efforts for ensuring internal coherence, as well as elements of rigour pertinent to research approaches such that nutrition and dietetics research makes a meaningful contribution to knowledge going forward.

CONFLICT OF INTEREST

Claire Palermo is Associate Editor and Dianne P. Reidlinger is Editor of *Nutrition & Dietetics*. This manuscript has been managed throughout the review process by the Journal's Editor-in-Chief. The Journal operates a blinded peer review process and the peer reviewers for this manuscript were unaware of the authors of the

manuscript. This process prevents authors who also hold an editorial role to influence the editorial decisions made.

AUTHORS' CONTRIBUTIONS

All authors conceptualised the study. Dianne P. Reidlinger completed the search and drafted the methods. All authors completed data analysis. Claire Palermo drafted the rest of the manuscript and Charlotte E. Rees and Dianne P. Reidlinger reviewed until all authors approved the final manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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